REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
REPORT ON
GREENHILL AVENUE STORAGE FACILITY

Underwood
McLellan Ltd.
Consulting Engineers and Planners

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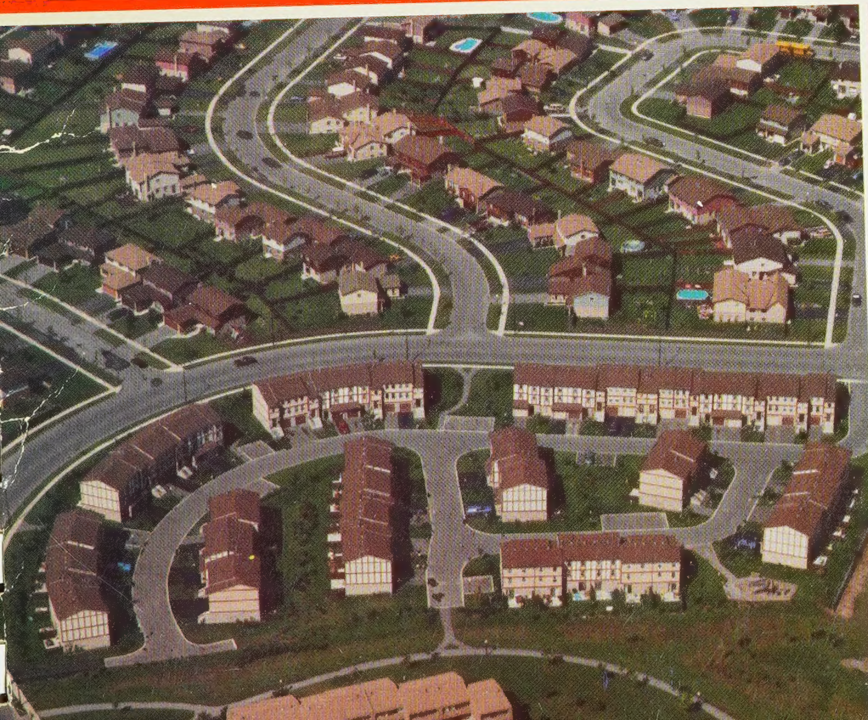

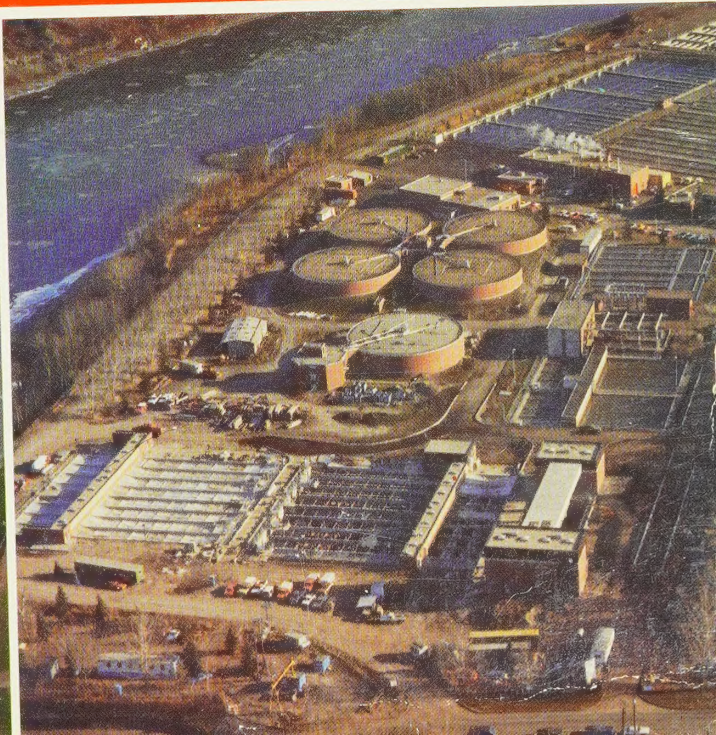

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REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
REPORT ON
GREENHILL AVENUE STORAGE FACILITY

Prepared for:

The Regional Municipality of
Hamilton-Wentworth
Department of Engineering
71 Main Street West
Hamilton, Ontario
L8N 3T4

Prepared by:

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November 24, 1981

Mr. J.R.G. Leach, P. Eng.
Commissioner of Engineering
Regional Municipality of
Hamilton-Wentworth
Department of Engineering
71 Main Street West
Hamilton, Ontario
L8N 3T4

Attention: Mr. K.A. Brenner, P. Eng.

Dear Sirs;

Re: Greenhill Avenue Storage Facility

We are pleased to enclose herewith twenty copies of our preliminary engineering report on this project which has been prepared in accordance with the requirements of our engineering agreement.

The preliminary design has been completed for both a fully covered and a partially covered structure and it is recommended that the facility be fully covered. The second cell will contain sewage approximately forty-six times each year and could lead to significant odour complaints if it is not covered. Further, with the location of the facility adjacent to a public park and to existing residents, it is anticipated that it would be difficult to prevent unauthorized entry even if the site is fenced.

We would be pleased to review the report with you at your convenience.

Yours very truly,

UNDERWOOD McLELLAN LTD.

Mario Bruno, P. Eng.,
Vice President & Manager - Eastern Canada

MB:KR:sd
Encl.

INDEX

1.0 INTRODUCTION

The existing Greenhill Avenue sanitary trunk sewer serves a combined sewer area and outlets to the Redhill Creek trunk which flows to the Woodward Avenue sewage treatment plant.

The existing Redhill Creek trunk does not have the capacity to carry the full flow collected by the tributary system and a bypass regulator chamber is located just upstream from the connection point on the Greenhill trunk to discharge excess flows to the Redhill Creek.

The Region of Hamilton-Wentworth had a study conducted by Proctor and Redfern in 1977 on the alternatives that could be implemented to decrease the discharge of combined sewage overflows into the Redhill Creek. This report recommended the construction of a partially covered 90,800 cu.m storage facility with a 22,700 cu.m covered cell and 68,100 cu.m open cell to achieve an 80% reduction in the number of overflows and their associated contaminant loads.

The Region of Hamilton-Wentworth has decided to construct a facility with a total storage capacity of 60,000 cu.m as this would achieve an approximate reduction in overflows by 65% or 32 out of the current approximately 49 events per year. The volume in the overflows would correspondingly be reduced by approximately 82% and the BOD reduced by approximately 88%. These calculations were based on an interpretation of the data presented in the Proctor and Redfern report.

Underwood McLellan Ltd. was retained by the Region of Hamilton-Wentworth to complete the preliminary design, detail design and contract administration services for the construction of the facility. The report, which follows, outlines the preliminary engineering for the contemplated facility.

2.0 SITE DESCRIPTION

The location selected for the Greenhill Avenue treatment facility is on the north side of the easterly extension of Greenhill Avenue, adjacent to the Redhill Creek and the existing Greenhill and Redhill Creek trunks.

The site is generally treed and has an elevation of approximately 98 m which is some 27 m lower than the houses which front on to Rosseau Road. These houses would be approximately 76 m west of the west limit of the treatment facility. The topographic mapping for the site was prepared by Underwood McLellan Ltd. using standard air photo mapping procedures.

The Regional flood elevation for Redhill Creek is 106.7 m and, under such a flood condition, the entire facility site would be flooded. Further, the Greenhill Avenue trunk would also be flowing at maximum capacity, the treatment facility would be full and such a flood would not affect the structure. However, all motors and electrical gear should be located above elevation 106.7 m.

3.0 EXISTING WORKS

3.1 Greenhill Avenue Trunk

This is a 3,048 mm by 3,048 mm box culvert trunk sewer with a maximum recorded flow of 19.36 cu.m (680 cfs[1]) per second and with an average flow of 1.26 cu.m per second. The maximum day flow for this trunk is estimated to be 2.52 cu.m per second based on Proctor and Redfern's findings.

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1. Report, Proposed Greenhill Combined Sewage Storage Facility, April 1977, Proctor and Redfern Limited, Table 3.

3.2 Redhill Creek Trunk

The existing trunk upstream from the connection with the Greenhill Avenue trunk is a 1,372 mm pipe with a minimum gradient of 0.4%. This trunk has a peak flow capacity of 3.54 cu.m per second.

Downstream from the connection with the Greenhill Avenue trunk, the Redhill Creek trunk is 1,676 mm in diameter and has a 0.4 gradient and a capacity of 6.09 cu.m per second. Accordingly, the capacity in this trunk to receive flows from the Greenhill Avenue trunk is 2.55 cu.m per second which is approximately the projected maximum day flow in the Greenhill Avenue trunk of 2.52 cu.m per second.

3.3 Watermain

An existing 300 mm trunk watermain is located just south of Greenhill Avenue and has a 523 kPa (75.8 psi) at the intersection of Greenhill Avenue and Rosseau Road. The available pressure at the treatment facility site will be approximately 690 kPa (100 psi). Water from this main could be used for the cleaning of the treatment facility.

4.0 SOILS INVESTIGATION

Trow Limited, Consulting Engineers, were retained by the Region of Hamilton-Wentworth to carry out a soils investigation of the project site. The Trow report is now on file with the Region.

It is noted that, due to the lack of access to a portion of the facility site, the soils investigation was not completed.

The following excerpts are taken from this report:

"The subsoil was observed to vary only slightly across the site. Generally, a surficial layer of topsoil and organic approximately 0.3 m (1-foot) was underlain by clay silt.

The clay silt deposit was stiff to hard in relative consistency and observed to extend to about elevation 93 m (305 ft.) over most of the site. This deposit was underlain by dense to very dense reddish gray silt till between elevation 91.5 m to 93.0 m (300 ft. to 350 ft.). Occasional gravel and sand interbedding was observed in this stratum. The silt till extended generally to about elevation 88 m (289 ft.) where weathered Queenston shale was encountered." (Pg. 4)

"The water table (ground) was interpreted to stabilize at about elevation 94.5 m (310 ft.). --- This level may be substantially higher during wetter periods." (Pg. 4)

"The proposed storage tank walls and floor may be supported using conventional spread footings located in the clay silt deposit or the underlying silt till. Footings founded in the clay silt below approximately elevation 96.1 (315 ft.) may be designed to support an allowable safe net bearing pressure of 0.19 MPa (2 tsf). Higher allowable safe net bearing pressures of 0.47 MPa (5 tsf) are available for spread footings placed in the dense to very dense silt till proven below about elevation 92 m (302 ft.)."

"All footings which may be exposed to freezing conditions must be provided with at least 1.2 m (4 ft.) of cover for protection from frost effects." (Pg. 5)

"It must be noted that the native soils encountered at the site are sensitive to freeze-thaw and percipitation effects." (Pg. 10)

"Permanent perimeter drainage must be provided around the proposed storage tank in order to prevent the build-up of hydrostatic pressures against the exterior walls." (Pg. 10)

"As previously discussed, uniform drains may be required if the ground water table is within 0.6 m (2 ft.) of the proposed tank base." (Pg. 10)

5.0 PRELIMINARY DESIGN

5.1 General

The floor elevation at the facility outlet must be located above the receiving trunk. The Redhill Creek trunk and the Greenhill Avenue trunk elevations are as follows:

Location	Elevation Invert	Elevation Obvert
1. Redhill trunk, 114 m downstream of the Greenhill Avenue trunk connection	94.37 m	96.05 m
2. Redhill trunk at the Greenhill Avenue trunk connection	94.94 m	96.62 m
3. Greenhill Avenue trunk at the existing regulation chamber	96.76 m	99.81 m
4. Greenhill Avenue trunk 175 m upstream from the existing regulatory chamber	102.15 m	105.20 m

To obtain adequate foundations and soil conditions, the footing elevation must be placed on or below elevation 96.1 m with a significant bearing capacity being achieved with the footings placed below elevation 92 m.

The minimum elevation that the facility floor can be placed at is elevation 97.50, at the inlet end, to provide an adequate gravity drainage outlet for the under drainage system. The top water level in the facility is not restricting because the Greenhill Avenue trunk does not have any connections to it east of Rosseau Road.

A maximum practical water depth of 6.5 m has been selected in order to limit the area of the facility. Accordingly, the top water elevation of the structure would approximate 104.0 m and the top of the covered portion of the structure would approximate 106.25 m. The top of the structure would be flooded with a water depth of approximately 0.45 m under a Regional storm condition on the Redhill Creek. This should not be a point of concern because, with such an event, the facility would be full with excess stored flows from the Greenhill Avenue trunk.

The existing regulatory structure will be retained, but only utilized in case of an emergency when sewage cannot be discharged to storage facility. However, the requirement for such an occurrence is not foreseen.

The total storage capacity of the faciity will be 60,000 cu.m. Having regard to alternatives for the design of the roof structure, the most economical design would be achieved with a maximum beam span of 21 m. Accordingly, the first cell would be 21 m wide, 100 m long with a storage capacity of 15,000 cu.m.

The second cell will be 63 m wide, 110 m long with a storage capacity of 45,000 cu.m. The overall structural dimensions will be 84 m by 110 m, which can be accommodated on the project site.

It is proposed that a chlorination system, or similar disinfection, not be provided. For all occurrences, when a bypass to the Redhill Creek is necessary, the creek flows will be high and the facility effluent will be diluted with storm water. It is noted that the bypass flows will be mainly storm water with most organics and settleable solids retained in the facility. To include a disinfection system using chlorine, it would be necessary to purchase the chlorine either as a liquid-gas or as sodium hypochlorite with the stored quantity being quite large. This system would have to be thoroughly flushed with clean water after each use in preparation for its subsequent need.

This would represent a rather onerous task and some danger in the storage of a large quantity of chlorine at an unmanned location adjacent to a public park.

The estimated chlorination requirements for the various flow conditions are shown in the following tabulation: (A chlorine dosage of 10 mg/l has been estimated as the quantity required to achieve a measureable chlorine residual.)

OVERFLOW CONDITION	CHLORINE QUANTITY kgm/hour	AVERAGE DURATION hour/year
Peak rate of 16.84 cu.m per second (19.36 - 2.52 cu.m per second)	606	N/A
Average rate of 7.74 cu.m per second [10.26[1] (362 cfs[1]) - 2.52 cu.m per second]	279	20.3 (565,700 cubic metres[2] per year ÷ 7.74 cubic metres per second flow rate ÷ 3,600 sec./hr.

The estimated total chlorine consumption would be 5,675 kg per year (565,700 cu.m per year at 10 mg/l).

The facility has been located on the project site to minimize the number of trees that would have to be removed and to achieve minimum earth excavation quantities.

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1. Report, Proposed Greenhill Combined Sewage Storage Facility, April 1977, Proctor and Redfern Limited, Table 3.
2. Proctor and Redfern report, Page 25, 730 mg/yr. 18% overflow.

5.2 Process Design

The floor design is the most important aspect affecting the on-going maintenance of the facility. It is important that the floor be relatively watertight and suitable for cleaning and removal of settled sludge.

A number of alternatives have been considered for the removal of sludge and for a floor finish.

Sludge Removal

The most positive sludge removal system would include the installation of sludge scrapers to plow settled sludge into a series of collector channels where the sludge would be removed by the normal sewage flow through the tank. Such an arrangement would require the purchase of four separate mechanisms, each 21 m long and the installation of a drive system that normally would be operated only infrequenly. Both the capital and operating/maintenance costs would be significant.

The alternative, and recommended arrangement, is to construct a concrete flow channel 1,000 mm wide x 500 mm deep along the centre of each 21 m compartments. The tank floor would be constructed with a slope of 6:1 (6 horizontal to 1 vertical) extending from the top of the channel to the sides of each compartment. In this way, the effective wall height would be reduced by approximately 1.7 m. Debris and settled solids could then be flushed into the channel using a stationary spray-down system. At the conclusion of each storm condition, the smaller cell could be first cleaned followed by diverting the entire dry weather flow into each of the three compartments of the large cell and sequential operation of the spray-down system. The large cell would only require cleaning following storm events where it was necessary to place it into operation.

The entire cleaning operation would be completed through the remote control of all valves from the Woodward Avenue plant. This would include the operation of inlet flow valves into each compartment and the operation of control valves on the spray-down system. The operational sequence for the spray-down system would be as follows:

1. Open valve S-6 and allow the large tank to be dewatered at a controlled rate so as to not exceed the capacity of the Redhill trunk.

2. Observe the sewage flow meter and confirm that the flows have subsided to approximately 2.5 cu.m per second.

3. Open valve S-5 and open valve W-1 on the spray-down system and leave open for approximately 15 minutes, then close valve W-1 and open valves, W-2, W-3 and W-4 in sequence similar to the operation of valve W-1. Complete the cleaning of Compartment No. 1.

4. Open valve S-4 and close valve S-3. Leave valve S-5 open. Open and close valves W-5, W-6, W-7 and W-8 in sequence to complete the cleaning of Compartment No. 2.

5. Open and close valves W-9, W-10, W-11 and W-12 in sequence to clean Compartment No. 3.

6. Open and close valves W-13, W-14, W-15 and W-16 in sequence to clean Compartment No. 4.

7. Open valve S-3 and close valve S-4 with S-6 closing to be approximately 15 minutes after S-4.

The cleaning time for the entire facility will be approximately four to five hours. It is noted that Compartment No.'s 2,3 and 4 only require cleaning if the storm event was large enough to require the detention of excess flows in these Compartments.

Flow Measurement

Flow sensing devices are required in the 3,048 x 3,048 box culvert and the 1,220 outlet sewer. It is recommended that the flow sensing element be similar to the unit supplied by Aer-O-Flo of Hamilton where a monitor device is attached to the invert of the conduit to measure both velocity and sewage flow depth. Flow indication should be available at the facility control building with recording located at the Woodward Avenue plant. In addition, liquid depth sensing using the stilling well principle will be required to indicate when an overflow from Compartment No. 1 to Compartment No. 2 and from Compartment No. 4 to the Redhill Creek is occurring. This equipment would show overflow rates with indicating and recording equipment as described for the main flow metres.

Valves

All sewage flow control valves would be of the sluice gate rising stem type, electric motor operated with both on-site manual operation and remote operation from the Woodward Avenue plant.

All watermain flushing valves would be motor operated butterfly valves with operational features identical to the sewage valves.

The switching from remote to manual operation and vice versa will be on-site controlled to prevent accidental remote operation of a valve while operator personnel are on-site.

Compartment Entrance Ramp

In accordance with the Client's instructions an entrance ramp will be provided to enable entry for a small tractor should this be necessary in the future. The ramp slope will be 3:1 with a ribbed concrete finish to facilitate traction. A flatter slope is not possible to achieve the necessary head room clearance.

Access

Access hatches would be provided at each end of Compartment No. 1 and a total of three in Compartment No.'s 2, 3 and 4, at each of the control gate houses and at the vehicle ramp building.

Gravity ventilation will be provided at each access hatch.

Overflow

Overflow from Compartment No. 1 to Compartment No. 2 would be by achieved through an opening in the separating wall approximately 70 m long by 0.30 m high. Overflow from Compartment No. 4 to the Redhill Creek trunk would be achieved by constructing a weir launder type collector approximately 70 m long along the inside wall of the structure with outlet to a 3,660 mm new outfall culvert to the existing head wall structure.

5.3 Structural Design

Spread footings will be constructed to an elevation of 96.1 m, approximately, to achieve an allowable safe net bearing pressure of 0.19 MPa. To design the footings, it will be necessary to complete the soils testing program which was not possible due to inaccessability. Vertical walls will be reinforced concrete with the roof being supported on the tank walls in Compartment No. 1 and a combination of walls and columns in Compartment No.'s 2, 3 and 4. In all cases, the steel beam that supports the roof slab will be specified to be manufactured from the steel currently used in MTC bridges. This steel will not require maintenance because the rust that is formed provides a protective coating to minimize further rusting. Alternative methods of roof construction have been examined in detail such as double Tee deck beams as used in parking garages, pre-cast concrete girders as used in highway bridges, etc. However, due to the desire to achieve a maximum span and the required loading (to minimize intermediate column construction and

eliminate the need for a central row of columns in each Compartment), the recommended system is the most feasible and economical of the types investigated.

Stanley Structures Limited have been contacted. This firm manufactures the heaviest and longest pre-cast structural members in Ontario, but they cannot supply 21-metre span concrete beams for this project. A reduction to the span length has, therefore, been considered. The first compartment must be 21 metres in width to provide the necessary storage requirements. A shorter beam length could only be utilized if two flow channels with a centre row of columns and girders were provided which would increase the cost of the project over that proposed. Also, in addition to a similar condition being required in the large Compartment, the access ramps would not be feasible due to inadequate head room.

In the event that it is decided to not place earth over the covered structure, then a minimum of 50 mm of asphalt should be placed over the concrete deck slabs.

Because the selected design provides a gravity under-drainage system, the structure will not experience uplift hydraulic pressures. This design reduces the structural requirements of the perimeter walls and simplifies the design of the floor system.

A concrete collection launder with adjustable weir plate and scum baffle, 70 m long located at an elevation of 103.6 m, would collect any overflow from the second cell and direct it to a 3,660 CMP pipe culvert with outlet to the existing headwall structure. The inlet conduit would be a 3 m x 3 m poured-in-place concrete culvert.

An asphalt floor has been considered, but due to the difficulty in placement and compaction, coupled with oxidation and cracking of the floor which would be the most severe concern if the facility were not covered. It appears that a low strength concrete floor would be the most appropriate. Accordingly, a wire mesh reinforced concrete floor is recommneded.

Structural concrete members would be designed based on 28 MPa concrete strength utilizing standard deformed reinforcing bars with a requirement for 5% entrained air content.

Two alternative designs have been considered, one wholly covered and the other only partially covered. Two artist rendition sketches of the facility, covered and partially covered, have been prepared and are appended at the back of the report.

Covered Alternative

This alternative does not require the provision of frost protection measures. The roof, with 500 mm of soil cover, would provide adequate frost protection for all wash-down piping, valves, footings and underdrains.

Structurally, the top of the walls would be supported by the roof membrane which would reduce the perimeter wall and footing cantilever design requirements as compared to an uncovered tank.

The covered design would allow for a total depth of 500 mm of earth, as noted, to be placed on the roof, with allowance for grass mowing equipment, medium weight service trucks, etc. The design of exposed access structures would incorporate vandal-proof features because it is proposed that the facility not be fenced.

Partially Covered Alternative

The smaller of the two cells would be covered as in the totally covered alternatives. This 15,000 cu.m cell would have sewage flowing through it at all times and, with the restricted outlet conditions, would frequently contain relatively large volumes of raw sewage. Accordingly, in view of the environmental sensitivity of the location for the facility this cell should be covered.

The secondary cell could be constructed with perimeter walls similar to the fully covered alternative, except that the footings and wall design would be required to support a greater backfill soil pressure force. With the uncovered secondary cell the spray-down system would be designed to provide for free draining after each use during the winter months and heating cables would be required to prevent freezing of the outlets sluice gates. However, a 'January thaw' followed by a rapid down-turn in temperatures may cause sever operational problems, for example freezing of the sluice gate guides and operation of the wash-down system. Also, it would be necessary to fence the entire facility and the open tank would obviously be aesthetically unpleasant at this location, particularly for the residents along Rosseau Road.

The Regional Municipality of Niagara has a similar uncovered facility in Welland. It is necessary that it be cleaned shortly after each use because of odours. Although the project site is adequately fenced, it has become increasingly difficult to keep juveniles out of the structure because the concrete floor provides a good surface for skateboarding.

5.4 Construction Procedure

The following procedure has been prepared to indicate how the facility could be constructed without requiring an overflow of sewage to Redhill Creek. The general contractor would be permitted to establish his own construction procedure which would be reviewed for acceptability for the project.

1. Construct the storage facility, including all control valves and wash-down system ready for operation.

2. Construct the inlet box culvet to the Greenhill Avenue trunk.

3. Construct the outlet connection from the facility up to the connection pipe between the Greenhill Avenue and Redhill trunks. Complete the construction of the connection of the facility outlet trunk to the Redhill trunk by cutting out a side wall in the connecting pipe and making good all joints.

4. Cut out the top of the existing box culvert upstream from the proposed connection to the storage facility. Install structural steel members on the side walls of the culvert such that stop logs can be placed to minimize the flow in the downstream section. Install a temporary pump in the flooded section of the box culvert with a pumping capacity of about 1.3 cu.m per second, with overland pipes to the completed storage facility. Cut into the existing box culvert at the location of the inlet connection to the storage facility and install stop logs in the Greenhill Avenue trunk. Remove the temporary pump, stop logs and support steel.

5. Place the facility into normal operation.

6.0 ESTIMATE OF PROBABLE CONSTRUCTION COSTS

The following estimate of probable construction costs has been prepared to show each item that would be included in the construction specifications based on the standard sixteen division format. The estimate has been prepared on the basis of an April 1982 construction start with a seventeen month construction period.

TABLE 1

GREENHILL STORAGE FACILITY
ESTIMATE OF PROBABLE COSTS

	ITEM DESCRIPTION	PARTIALLY COVERED	FULLY COVERED
1.	General work including set-up, access, bonds, etc.	$ 80,000	$ 85,000
2a.	Clearing, clean-up and completion	$ 20,000	$ 20,000
2b.	Excavation, including disposal and groundwater control	$ 210,000	$ 190,000
2c.	Backfill, including imported granular materials	$ 270,000	$ 310,000
2d.	Permanent under drain and perimeter drain system	$ 46,000	$ 49,000
2e.	Access roads, including imported materials	$ 31,000	$ 31,000
2f.	Sewers and water service	$ 56,000	$ 56,000
2g.	Concrete paving inside storage tanks	$ 260,000	$ 260,000
2h.	Landscaping, including topsoil	$ 54,000	$ 74,000
2i.	Security fence around site, including gates	$ 48,000	$ ---
3a.	Construction of 3 m x 3 m box culvert	$ 284,000	$ 284,000
3b.	Alteration to existing concrete structures	4 128,000	$ 128,000
3c.	Sluice gates housing and control building structures	$ 100,000	$ 100,000
3d.	Foundation for perimeter walls	$ 570,000	$ 440,000
3e.	Tank walls	$1,460,000	$1,210,000
3f.	Supporting columns for roof girders	$ ---	$ 125,000
3g.	Girders supporting roof	$ ---	$ 90,000
3h.	Prestressed concrete roof slabs (Spirroll)	$ 135,000	$ 440,000
4.	Control building superstructure (block)	$ 26,000	$ 26,000
5a.	Roof supporting beams (weathering steel)	$ 246,000	$ 840,000
5b.	Miscellaneous steel and aluminum work	$ 56,000	$ 49,000
7.	Thermal and moisture protection	$ 22,000	$ 14,000
8.	Doors, frames, louvres	$ 2,000	$ 2,000
9.	Finishes	$ 6,000	$ 6,000
15a.	Spray-down system	$ 114,000	$ 108,000
15b.	Sluice gates, including supports and drives	$ 130,000	$ 130,000
15c.	General mechanical work	$ 32,000	$ 32,000
15d.	Outdoor control including, ozonation, vents and fans	$ 70,000	$ 87,000
16a.	Electrical work	$ 45,000	$ 48,000
16b.	Control systems, including link up with Woodward Avenue	$ 40,000	$ 36,000
	Contingency allowance for construction	$ 217,000	$ 264,000
	Total Probable Construction Cost	$4,768,00	$5,534,000

7.0 CONCLUSIONS

1. The only factor favouring the construction of the partially covered structure is cost.

2. The first cell requires a suitable cover to minimize odours and maintenance and to hide the appearance of raw sewage.

3. A partially covered facility would require a security fence, particularly because the project will not be continuously manned.

4. Potential freezing difficulties could be experienced with the under-drain system, wash-down system, winter clean-up and outlet sluice gates with the second cell being uncovered.

5. The second cell will contain sewage approximately 46 times each year.

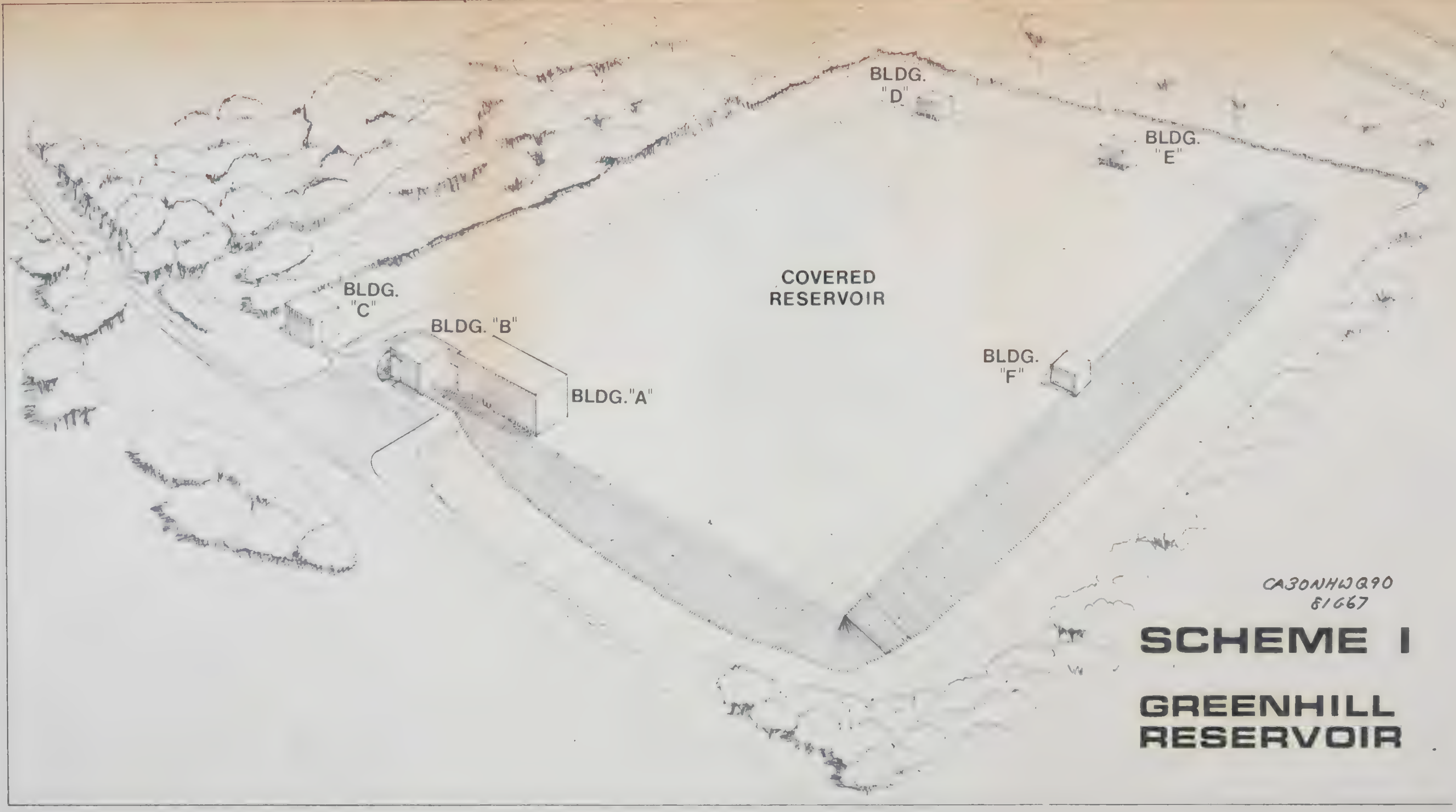
8.0 RECOMMENDATIONS

It is recommended that, if finances are available, the covered alternative be constructed because the facility will be located within a public park and adjacent to existing residences.

Prepared by;

Karl Reichert, P. Eng.,
Director, Environmental Engineering &
Assistant Branch Manager

Underwood McLellan Ltd.

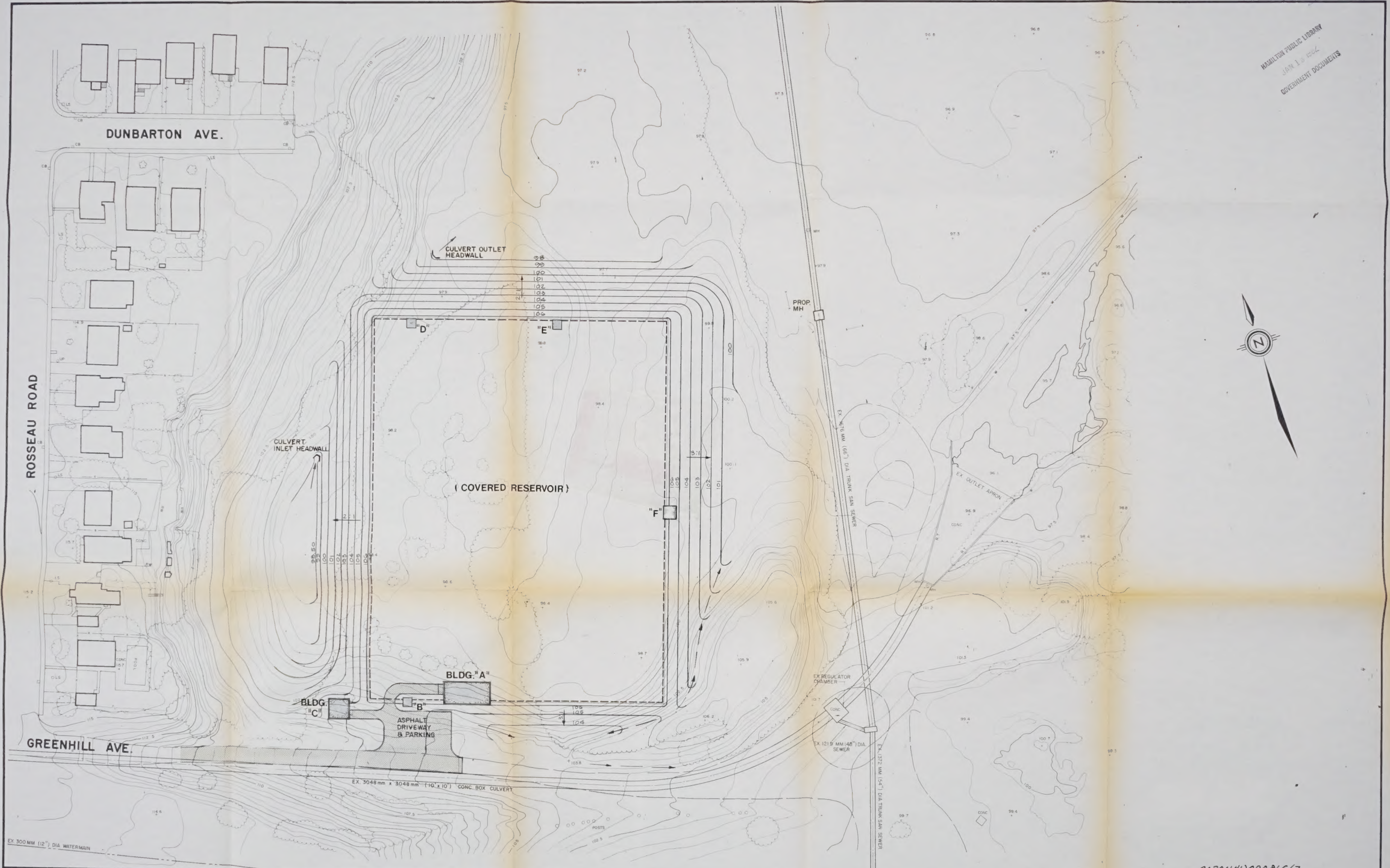


SCHEME I

GREENHILL RESERVOIR

SCHEME II

GREENHILL RESERVOIR



REGIONAL MUNICIPALITY OF HAMILTON WENTWORTH

GREENHILL STORAGE FACILITY

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Underwood McLellan Ltd.
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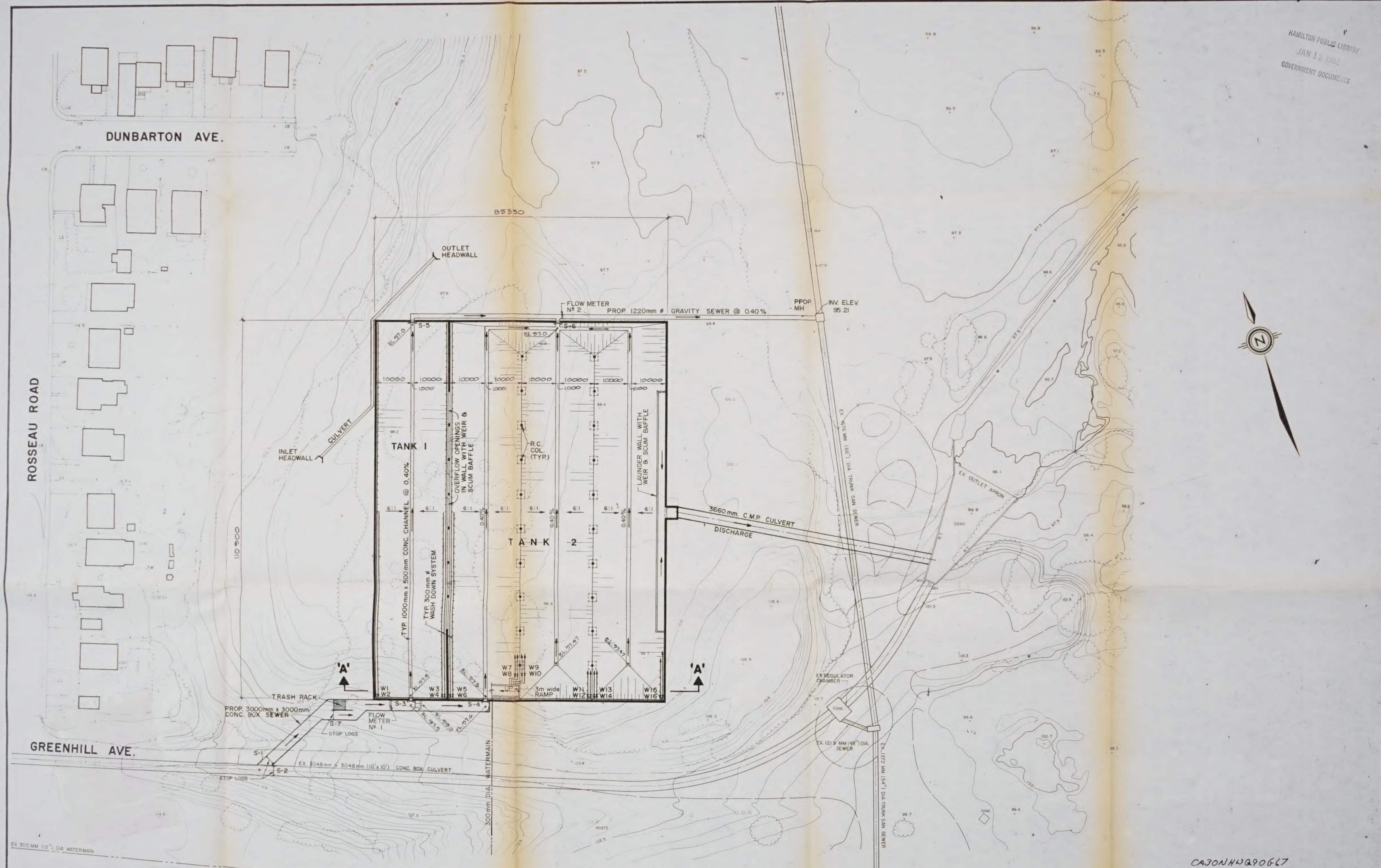
69 CARLINGVIEW DRIVE, REXDALE, ONTARIO, M9W 5E4
TELEPHONE (416) 675-6484 TELEX 06-989210
the uma group

CONSULTING ENGINEER

SITE PLAN

JOB NO. 1931-023
SCALE 1:500
DRAWING NO. 3
SHEET 3 of 5

Hamilton-Wentworth. Dept of Engineering
Regional Municipality of Ham-Went report on Greenhill Ave storage facility



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REGIONAL MUNICIPALITY OF HAMILTON WENTWORTH	
GREENHILL STORAGE FACILITY	

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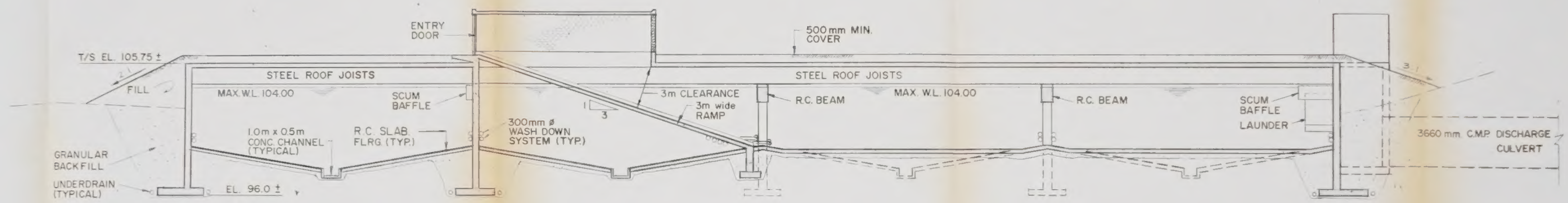
CONSULTING ENGINEER

LAYOUT PLAN

JOB NO.	DRAWING NO.	SHEET
1931-023	4	4 of 5

SCALE 1:500



SECTION 'A'-'A'

REGIONAL MUNICIPALITY OF HAMILTON WENTWORTH

GREENHILL STORAGE FACILITY

REV	Y	M	D	REVISION DESCRIPTION	DRN	SUPV	DES	CHK	ENG
0	81	11	26	PRELIMINARY	A.O.	T.B.		A.D.	A.D.

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CONSULTING ENGINEER

CROSS SECTION

JOB NO. 1931–023
SCALE 1:200
DRAWING NO. 5
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